

# THE QUALITY OF THE MATERIALS AND TECHNIQUES USED TO ACHIEVE THE ROMAN ROADS IN ALGERIA

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## ABSTRACT

*The channels offer a very interesting archaeological material, because they give us opportunity to understand the history of history besides this, they are also factors that increase membership and territorial identity. Roman roads are one of the hallmarks of the Roman Empire, which extends to North Africa. The realization of these pathways aimed to facilitate trade between the Roman provinces, and also to allow quick movement of armies. Roman roads are characterized by a very straight up avoiding swampy areas and the immediate vicinity of water courses.*

*This research on paths and Roman roads that are in Algeria is the result of a study on the quality of the materials and techniques used at that period of our history to build these roads.*

## 1. INTRODUCTION

It is the Romans, tireless builders, the word “road” comes from the Latin “via rupta, which means “open road”: the construction of a road (via) the supposed “break” the obstacles that arose hence the name “via rupta” or for short rupta. The Romans built routes linking the main cities of Italy and the Empire with the centers of political and economic decision. These channels allow the easy movement rather for the time, whether for the use of troops in the field or dealers and couriers [1].

The Roman Empire had a network of nearly 100 000 km of paths and roads to be equipped with all-season. Constructed and maintained in part at the expense of the Roman state, essential to establish the authority of Rome and facilitate rapid movement, the road network, which extends into the countries, the more remote, the vast sea of the Mediterranean, is a powerful vehicle for political and administrative control but also development for trade or movement of men. The major interest in the patyhs and streets during the Roman civilization, the Roman makes the honor of being proponents of enlargement and the paving of the street.

## 2. HISTORICAL BACKGROUND

From a strategic point of view, the defense of the Roman Empire was not only ensured border; actions on this side were complemented by the construction of a vast network of roads, military roads first, but served all the needs of a circulation of men and goods increasingly active [2]. The network of Roman roads was wanted by the Romans for strategic purposes, that is to say, to attach the territories conquered the rest of the empire but also to facilitate the movement of troops. The relative peace enjoyed by the empire from the first to third century allows travel across the province and even across the empire.

Conscious romaniser newly conquered territories, the emperor Caesar Augustus and his successor, in collaboration with his son General Agrippa, are at the origin of this exceptional road network. Built by and for the military to monitor borders and seas, the Roman roads provide quick route to connect troops and administrative centers. This period of peace is also conducive to trade and cultural exchanges and condition the settlement structure.

## 3. DEVELOPMENT OF PLOT

To serve military needs, the Roman roads are, as far as possible, straight sections over a long distance, they avoided the valleys, because they feared the destructive action of seepage and flooding, and passed preferably mid-coast [3]. In some cases, we did not hesitate to dig tunnels and light are penetrated by wells.

Roman roads, the minimum width were determined by the law of the Twelve Tables:  
- 8 feet for a plot in a straight line  
- 16 feet in the curved parts.

### 3.1. Classification of Roman roads

Roman roads were classified as:

- a- *Viae publicae*: are city streets were laid on a floor in the public domain and called "viae regiae", "consulares" or "praetoriae" according to the quality of the judges who had built;
- b- *Vicinal*: Used to connect the most important roads in rural villages;
- c – *Privatae*: was created by private land owners.

Two principles seem to have inspired the Romans:

- adapt in the best possible conditions in the region;
- set channels safe from infiltration by alternating layers of different materials, building a compact infrastructure and bulging surfaces to facilitate drainage ditches parallel to the road.

For example, the streets of Timgad in Algeria are straight and even strictly perpendicular to each other, within the perimeter that had defined the planners of Trajan. Timgad was crossed in all its length and across its width by two perpendicular paths, the *Cardo* and *Decumanus*, the first drawn from south to north, to Constantine; the second is in the west, to Lambèse. These two paths are now cleared in part, at least enough to make it possible to grasp the direction: they are paved with large rectangular slabs of limestone, Figure 1.



Figure.1 The *Cardo*: a street in the city of Timgad

### 3.2. Materials used by the Romans

To locate the axis of a Roman road used some proven tools such as [4]:

- a- *Groma*: "cross-staff" was used to facilitate the drawing of angles. It is composed of four branches and provided five son lead to allow drawing perpendicular from a central point lines, Figure 2;

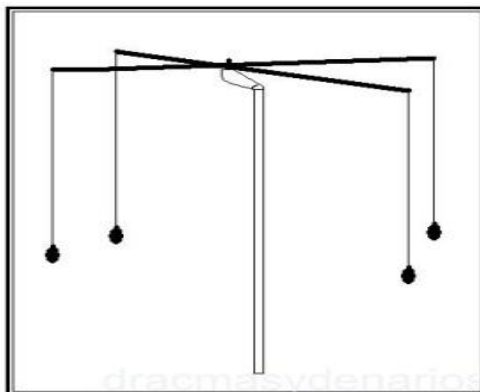
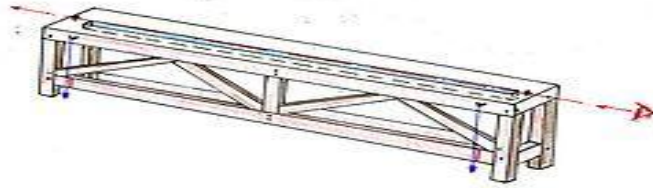


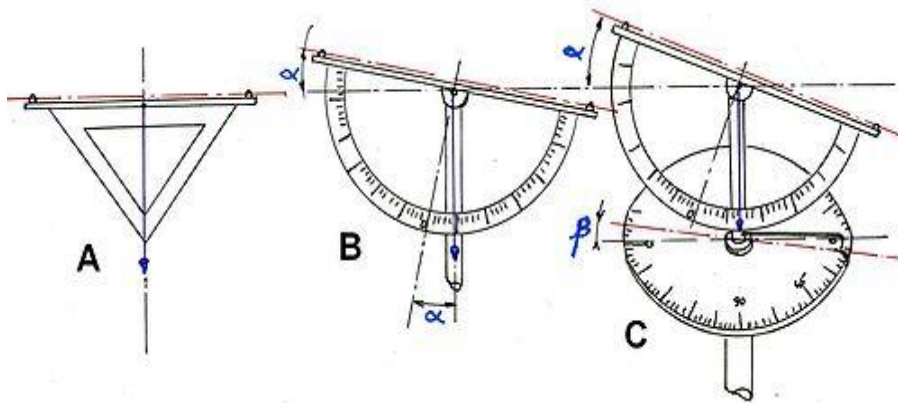
Figure 2. The groma

**b- Chorobate:** large scale (about 6 m) hard up and dug in its upper part with a groove containing water. It was used for the level calculation, to give a constant gradient in the raised areas, Figure 2.



**Figure 3.** Diagram of a chorobate

**c- Diopter:** instrument composed of a triangle with a plumb line. It was used for leveling of the road. The first interface was a simple horizontal referred instrument, see Figure 4 (a), consisting of an isosceles triangle whose base serves as a sight. The tip, where the two equal sides, is positioned at the bottom and serves as a benchmark to plumb. When it is in alignment with the tip, the sight through both eyepieces is perfectly horizontal. The first evolution, due to the engineer Heron of Alexandria, was to replace the triangle by a semi-circle graduated as a reporter in Figure 4-b. The system is driven into the ground after determining the level with plumb, and then the rotation of the slider allows you to select the desired angle, always according to the plumb line. A second trend shown in Figure 4-c, was the addition in the horizontal plane of a second disk, graduated 360 °, which allowed obtaining two specific angular orientations, Figure 3.



**Figure 4.** Diagram diopter

The Romans showed their know-how in the field of roads by:

- using natural means of communication (valleys, ravines), but avoiding the causes cleavage flooding (passage elevation) or weather;
- avoidance whenever possible swampy areas, major rivers and non-stable soils;
- production of tunnels and bridges, only to avoid detours too large, or to serve strategic centers or resources;
- channel is set quite high on the hills to be protected from flood zones. Crossing a river, a river is a major obstacle. It is ford, on floating bridges and bladderwort, sometimes on bridges, rarely or later on structures;
- when there was an obligation to cross the road passed over the ford (small streams) or on a bridge, wood or stone. In relief area, they borrow a path halfway up, for reasons of convenience and safety;
- lanes widened in the corners to allow carts, lacking limber, rotate at best.

#### 4. TECHNICAL EMPLOYEES

Achieving the roads themselves has always been very careful so that these routes are sustainable and usable at all times.

Roman technicians have adopted materials found locally with the following technical:

- The track is converted into a small mound with a slight convex to ensure perfect drainage;
- The spoil from the excavation side ditches are used for construction.

Construction techniques may vary from one channel to another, from one section to another, but are in fact according to the nature of the substrate and materials. The implementation stages of roads:

- The basis for the future road is then cleaned of all vegetation and humus surface over a width of 16-20 meters;
- The route is established by the engineer (*architectus*) and marked by surveyors (or *agrimensores gromatici*) using the *groma*;
- A gap is slightly widened in the axis of the future roadway;
- On either side of this gap, there is a car parked by two other ditches in the "V" remote almost 40 meters deep and 80 cm wide 2 meter band;
- The cuttings are brought to the center to form the tread;
- This layer is packed and groomed;
- It is then elevated with layers of clay and crushed stone to a depth of up to 1 meter;
- The assembly is covered and lies close large flint stones, sandstone blocks, slabs of limestone or shall;
- They are covered with a layer of gravel mixed with marl limestone that forms the basis passable;
- City roads are covered with slabs.



**Figure 5.** Implementation of a road

Figure 6 shows a section through the structure along the path through the city of Timgad.



**Figure 6.** Section in the structure of a route through the city of Timgad

## 5. STRUCTURE OF ROMAN ROADS

Only archeology can truly learn about the structure, the internal architecture of the monument road [5]. To build these roads, the Romans used local materials, practical and economic. The structure of this only archeology can truly learn about the structure, the internal architecture of the monument road. To build these roads, the Romans used local materials, practical and economic.

The structure of these ways: riprap, rather uneven, covered with several layers of pebbles and gravel. Figure 5 shows a section through the structure along the path through the city of Timgad.

A section made on a Roman road revealed a large structure of 6.50 meters, Figure 7. First they dug a big gap, to put in order:

- a- a base course of mortar (a mixture of sand and lime);
- b- a raft of large stones laid flat to equalize the rough surface;
- c- a second bed composed of crushed stones locally calibrated and groomed.

Everything was covered with well compacted sand extracted from the nearest river and exceptionally clinker, and then the structures of these tracks were covered with large stone slabs.

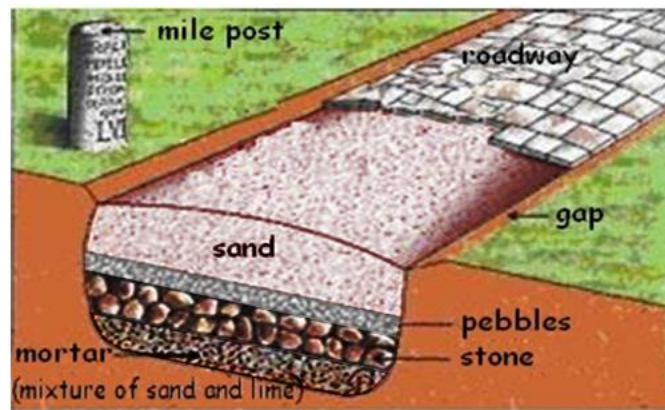


Figure 7. Section of a Roman road

Its seat is not perfectly horizontal but slightly inclined in the direction of the natural slope. The latter also increases after the track is that it was installed out of the slope, or the erosion of the slope has been accentuated by the way. Another cutting in a Roman road is shown in Figure 8.

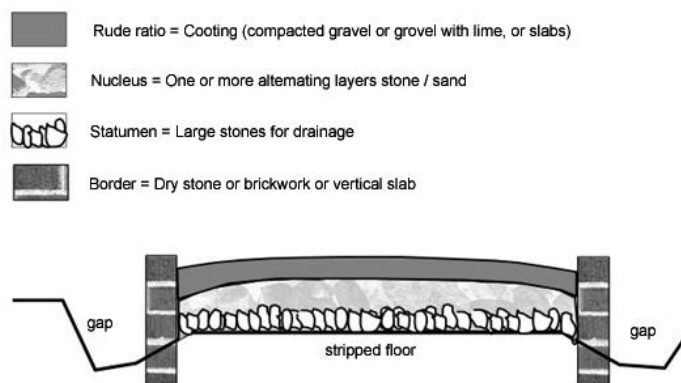


Figure 8. Section in a Roman road

The road looks like a floor solidly built sturdy materials. This floor has a width of 6 meters, and consists of:

- a-** With two rows of hard limestone borders aligned, ruling one and the other on each side and forming the collection of metalling, composed of two layers of stone carefully adjusted;
- b-** A layer of large stones for drainage;
- c-** A higher or second layer of flint and limestone mixed in Thickness: from 3 to 6 cm in diameter and shortbread;
- d-** Of a coating consisting of gravel packed with gravel or lime or a stone slab. The base is set in an arc of a circle. Figure 7 section in a floor of a Roman road.

Existing roads follow the same structure of the Roman roads that is to say, three-layer construction (surface layer, base layer and a base layer) Figure 9 shows a cross section of a Pavement.



**Figure 9.** A cross section of a Pavement

## 6. CONCLUSION

The research literature [6] has given a lot of information: the writings of several researchers in archeology and the field survey, based on observation and direct interviews were the support of this research point. From all this we can conclude, that Algeria has a well organized during the Roman road network. It is safe in fact that archeology and the study of the history of ancient Roman cities in Algeria can now shed more light on this subject. The current road engineers draw heavily on the structure of Roman roads for the true originality of the Roman road; it is the structure that we find.

The necessary intensification of scientific research highlighting local materials in construction enhancement, promotion and exploitation of local materials in construction, in terms of their adaptation and resistance to natural features.

Finally we can say that the Roman roads are more rigid than existing roadways. Because the surface of a Roman road is still made of high-strength materials.

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